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BLOOD AND TISSUE IDENTIFICATION OF SELECTED BIRDS AND MAMMALS, PART II: Cross Reaction Patterns of Birds and Mammals, Using Deer, Bovine, Raccoon, Chicken and Mallard Duck Antiserum, part 2

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Nebraska Game and Parks Commission

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Oates, David W. and Weigel, Debra L., "BLOOD AND TISSUE IDENTIFICATION OF SELECTED BIRDS AND MAMMALS, PART II: Cross Reaction Patterns of Birds and Mammals, Using Deer, Bovine, Raccoon, Chicken and Mallard Duck Antiserum, part 2" (1976). *Other Publications in Wildlife Management*. 9. <https://digitalcommons.unl.edu/icwdmother/9>

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Figure 9. The following reproductions illustrate avian cross-reaction patterns obtained from chicken antiserum and mallard duck antiserum, using immunoelectrophoresis and immuno diffusion. Table 1 summarizes immunoelectrophoresis cross-reactions. Species included in the study are listed below.

BIRDS

Chicken	<i>Gallus gallus</i>
Coot	<i>Fulica americana</i>
Crow	<i>Corvus brachyrhynchos</i>
Mourning Dove	<i>Zenaidura macoura</i>
Mallard Duck	<i>Anas platyrhynchos</i>
Golden Eagle	<i>Aquila chrysaetos</i>
Snow Goose	<i>Chen hyperborea</i>
Eared Grebe	<i>Podiceps caspicus</i>
Red-tailed Hawk	<i>Buteo jamaicensis</i>
Great Horned Owl	<i>Bubo virginianus</i>
White Pelican	<i>Pelecanus erythrorhynchos</i>
Ring-necked Pheasant	<i>Phasianus colchicus</i>
Pigeon	<i>Columba livia</i>
Prairie Chicken	<i>Tympanuchus cupido</i>
Bobwhite Quail	<i>Colinus virginianus</i>
Merriam's Turkey	<i>Meleagris gallopavo</i>

Table 1. Over 700 immunoelectrophoresis patterns are summarized here. To segregate protein components, the immunoelectrophoretogram was divided into five areas: (1) pre-albumin, (2) albumin, (3) α_0 and α_1 globulins, (4) α_2 and beta globulins (sometimes it is difficult to determine whether the apex of an arc is anodic or cathodic to the sample origin, therefore, these two components were combined), and (5) gamma globulins. Observations are indicated as follows:

x = a commonly observed protein arc

s = several commonly observed protein arcs

w = a weak or not always observable arc

ws = several weak or not always observable arcs

blank = no arcs observed

	Pre-albumin		Albumin		Alpha ₀ and Alpha ₁ Globulins		Alpha ₂ and Beta Globulins		Gamma Globulin	
	C*	M*	C*	M*	C*	M*	C*	M*	C*	M*
Chicken										
Serum	x	x	x	x	s		s	s	x	x
Dry Blood	x	x	x	x	ws	w	s	s	x	w
Meat		x	x	x	w		x	x	x	x
Coot										
Serum	x	x	x	x	x	s	x	s	w	w
Dry Blood	x	x	x	x	w		w	s	w	x
Meat			x	x			x	w	x	x
Crow										
Serum			x	x	x	x	s	s	w	x
Dry Blood	w	x	x	w	w	x	ws	ws	w	w
Meat	x	w	x	x	w	x	w	s	x	x
Mourning Dove										
Serum			w	x	s	s	s	x		
Dry Blood			w		x	x	w			x
Meat	w	w			x	x	w			x
Mallard Duck										
Serum	x	x	x	x	x	s	s	s	x	s
Dry Blood	w	w	x	x	ws	w	ws	ws	w	x
Meat			x	x		w		x	x	x
Golden Eagle										
Serum	w	w	x	x	x	s	x	s	w	w
Dry Blood		w	x	x	x	s	x	x	w	x
Meat			x	x		w			x	x
Snow Goose										
Serum	w	x	x	x	s	x	s	s		w
Dry Blood	w		x	x			w			x
Meat	x	x	x	x			ws	w		x

Table 1. Continued

	Pre-albumin		Albumin		Alpha ₀ and Alpha ₁ Globulins		Alpha ₂ and Beta Globulins		Gamma Globulin	
	C*	M*	C*	M*	C*	M*	C*	M*	C*	M*
Eared Grebe										
Serum		X	X	X	W	WS	S	S		S
Dry Blood	W	W	X	X		X			W	W
Meat	W	W	X	X		W			X	X
Red-Tailed Hawk										
Serum		X	X	X	X	S	WS	S		W
Dry Blood		W	X	X		X		W	W	X
Meat	W		X	X				W	W	X
Great-Horned Owl										
Serum	X	X	X	X	X	S	X	S	W	X
Dry Blood	X	W	X	X	X	S	W	W	W	W
Meat	X	W	X	X		W			W	X
White Pelican										
Serum	X	X	X	X	X	X	X	X		X
Dry Blood		W	X	X	X	W	W		X	W
Meat			X	X	W	W			W	W
Ring-necked Pheasant										
Serum	X	X	X	X	S	S	S	S	X	S
Dry Blood	W	X	X	X	W	X	W	X	X	X
Meat			X	X		W			X	X
Pigeon										
Serum		X	X	X	X	S	S	S	W	W
Dry Blood		W	X	X		X			X	X
Meat		W	X	X					W	X
Prairie Chicken										
Serum	X		X	X	S	S	S	S	X	X
Dry Blood	W	X	X	X			S	W	W	X
Meat			X	X			W			X
Bobwhite Quail										
Serum	X	X	X	X	S	S	S	S	X	W
Dry Blood	W	W	X	X	W	W	S	X		W
Meat			W	W			X			X
Merriam's Turkey										
Serum	X	X	X	W	S	S	S	S	X	X
Dry Blood		X	X	X	WS	W	S	WS	W	W
Meat			X	X	W		S	W	X	X

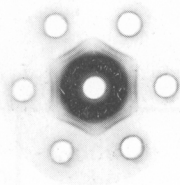
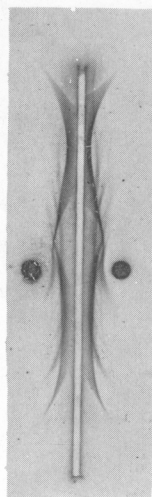
*C: chicken; M: mallard duck

	Pre-albumin		Albumin		Alpha ₀ and Alpha ₁ Globulins		Alpha ₂ and Beta Globulins		Gamma Globulin	
	C*	M*	C*	M*	C*	M*	C*	M*	C*	M*
Chicken										
Serum	x	x	x	x	s		s	s	x	x
Dry Blood	x	x	x	x	ws	w	s	s	x	w
Meat		x	x	x	w		x	x	x	x

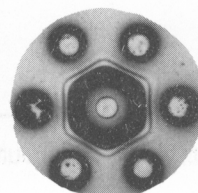
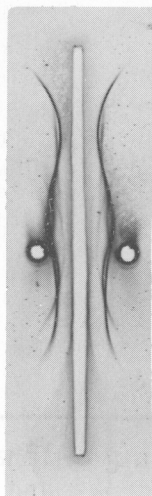
CHICKEN

Gallus gallus

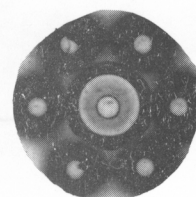
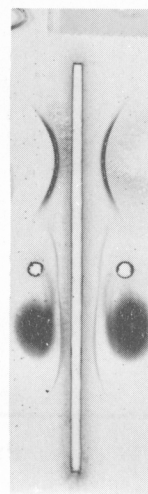
VERSUS CHICKEN ANTISERUM



Serum

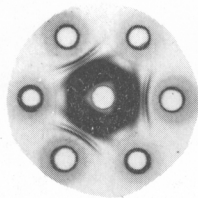
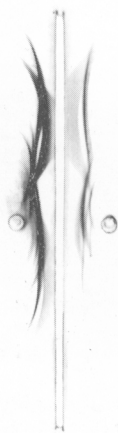


Dry Blood

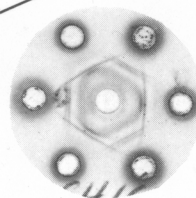
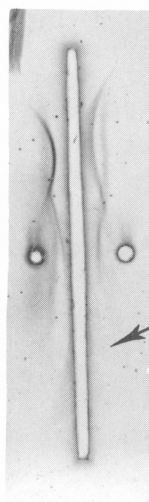


Meat

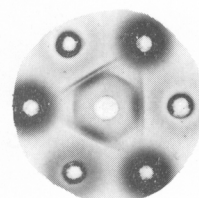
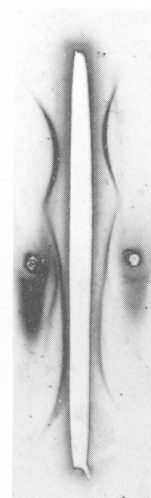
VERSUS MALLARD ANTISERUM



Serum



Dry Blood

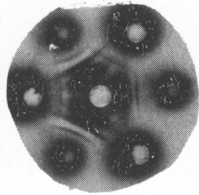
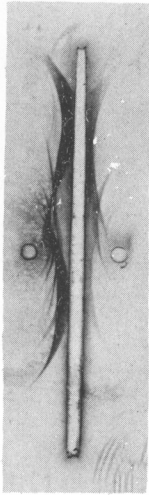


Meat

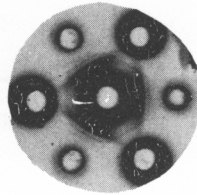
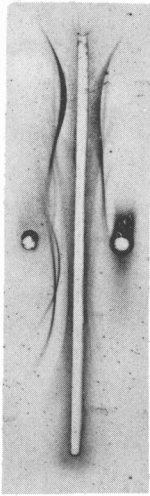
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	C*	M*	C*	M*	C*	M*	C*	M*	C*	M*
Coot										
Serum	x	x	x	x	x	s	x	s	w	w
Dry Blood	x	x	x	x	w		w	s	w	x
Meat			x	x			x	w	x	x

COOT
Fulica americana

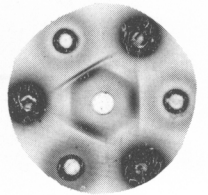
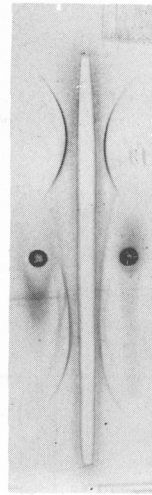
VERSUS CHICKEN ANTISERUM



Serum

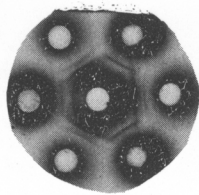
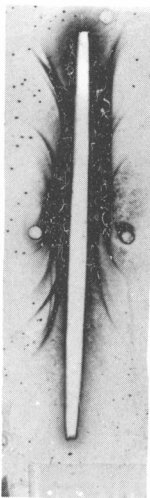


Dry Blood

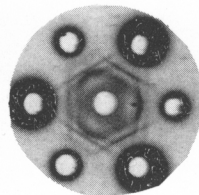
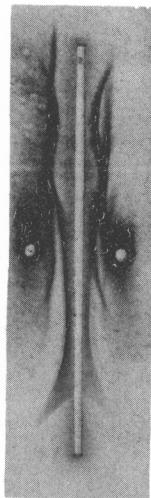


Meat

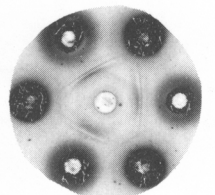
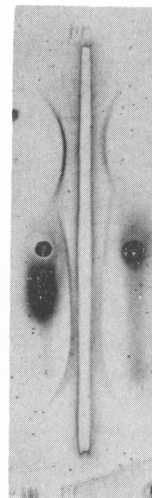
VERSUS MALLARD ANTISERUM



Serum



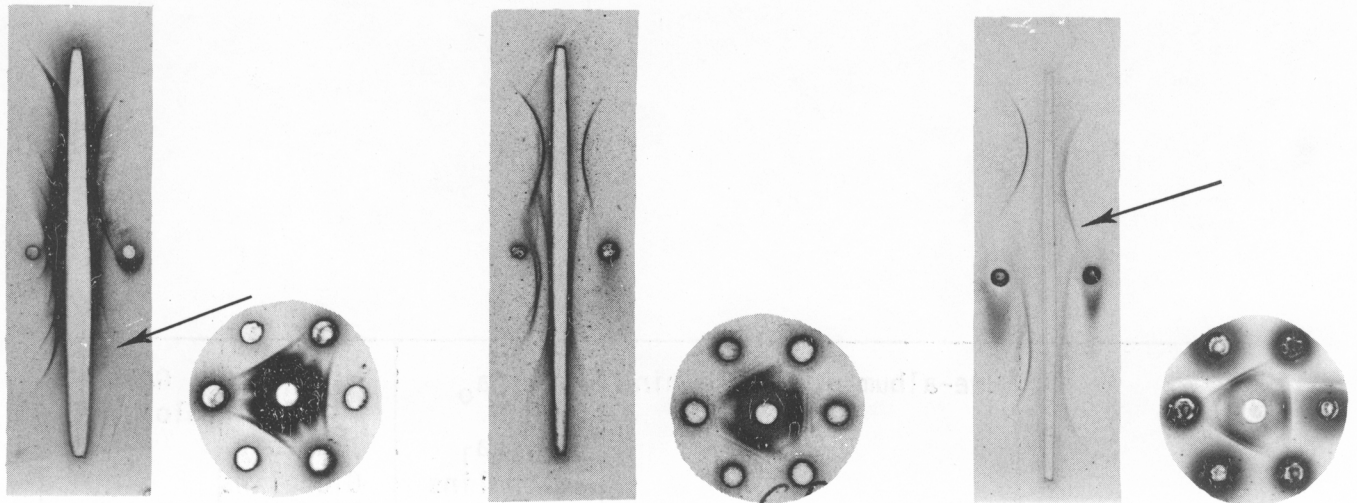
Dry Blood



Meat

CROW
Corvus brachyrhynchos

VERSUS CHICKEN ANTISERUM

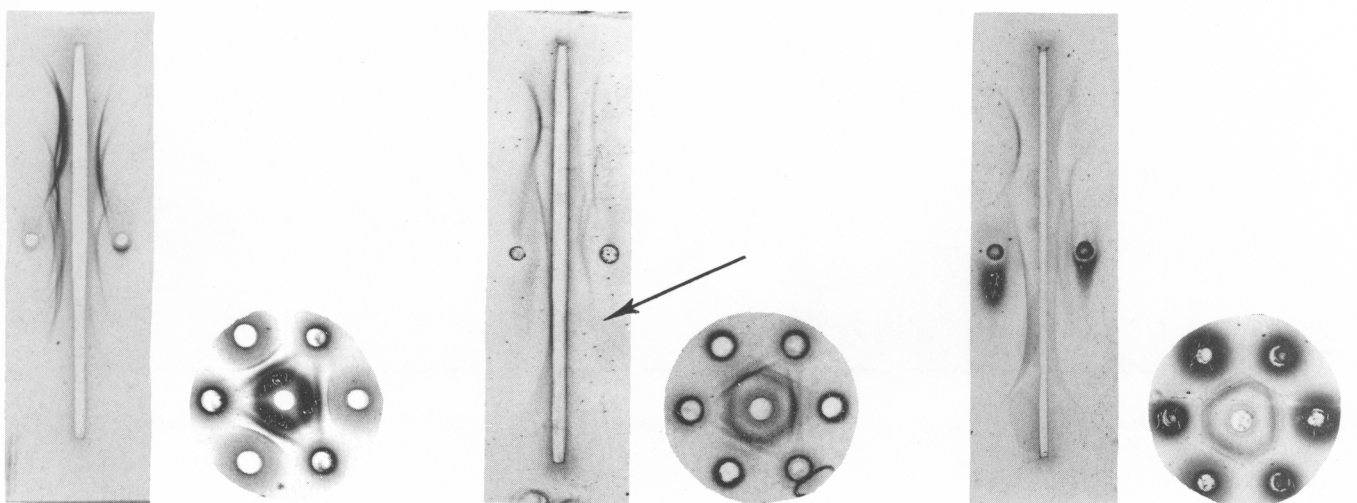


Serum

Dry Blood

Meat

VERSUS MALLARD ANTISERUM



Serum

Dry Blood

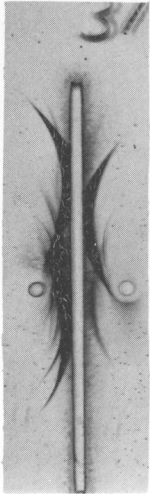
Meat

	Pre-albumin		Albumin		Alpha ₀ and Alpha ₁ Globulins		Alpha ₂ and Beta Globulins		Gamma Globulin	
	C*	M*	C*	M*	C*	M*	C*	M*	C*	M*
Mourning Dove Serum										
Dry Blood			W	X	S	S	S	X		X
Meat	W	W	W		X	X	W			X

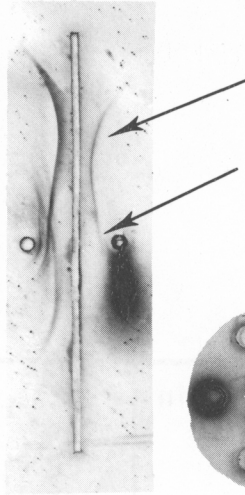
MOURNING DOVE

Zenaidura macroura

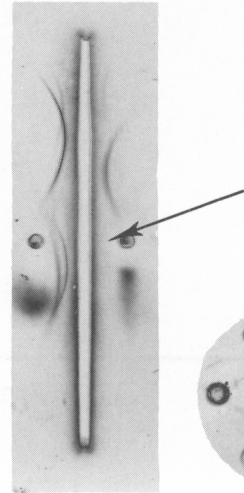
VERSUS CHICKEN ANTISERUM



Serum

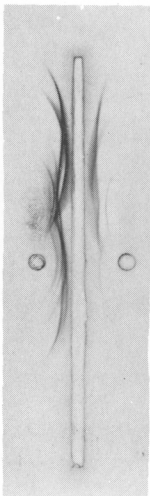


Dry Blood

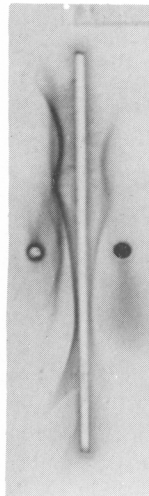


Meat

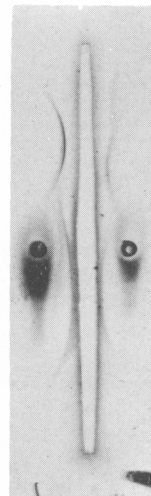
VERSUS MALLARD ANTISERUM



Serum



Dry Blood



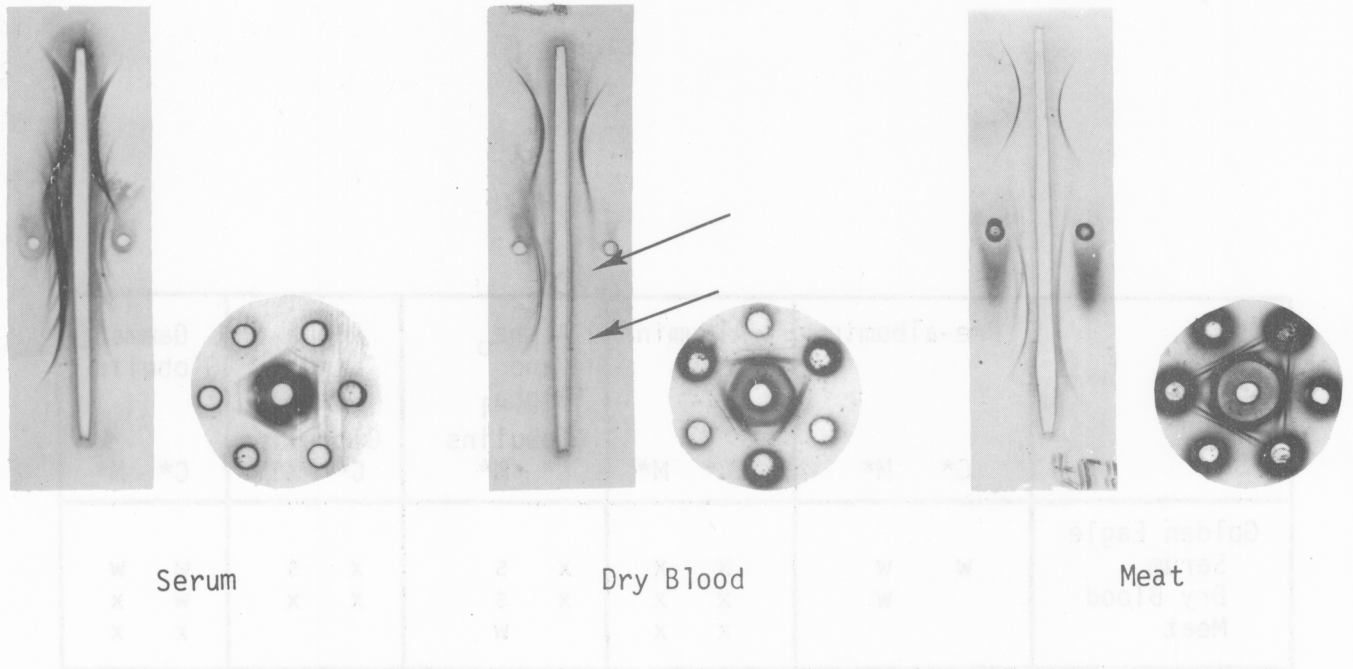
Meat

	Pre-albumin		Albumin		Alpha ₀ and Alpha ₁ Globulins		Alpha ₂ and Beta Globulins		Gamma Globulin	
	C*	M*	C*	M*	C*	M*	C*	M*	C*	M*
Mallard Duck										
Serum	x	x	x	x	x	s	s	s	x	s
Dry Blood	w	w	x	x	ws	w	ws	ws	w	x
Meat			x	x		w		x	x	x

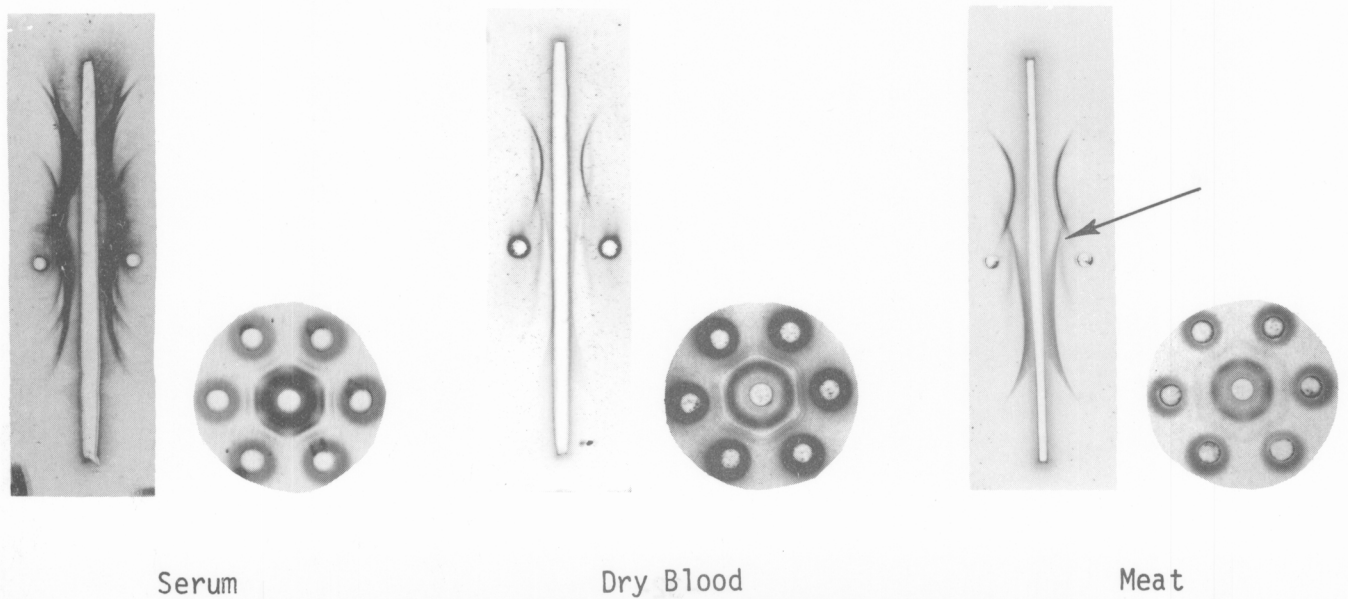
MALLARD DUCK

Anas platyrhynchos

VERSUS CHICKEN ANTISERUM



VERSUS MALLARD ANTISERUM

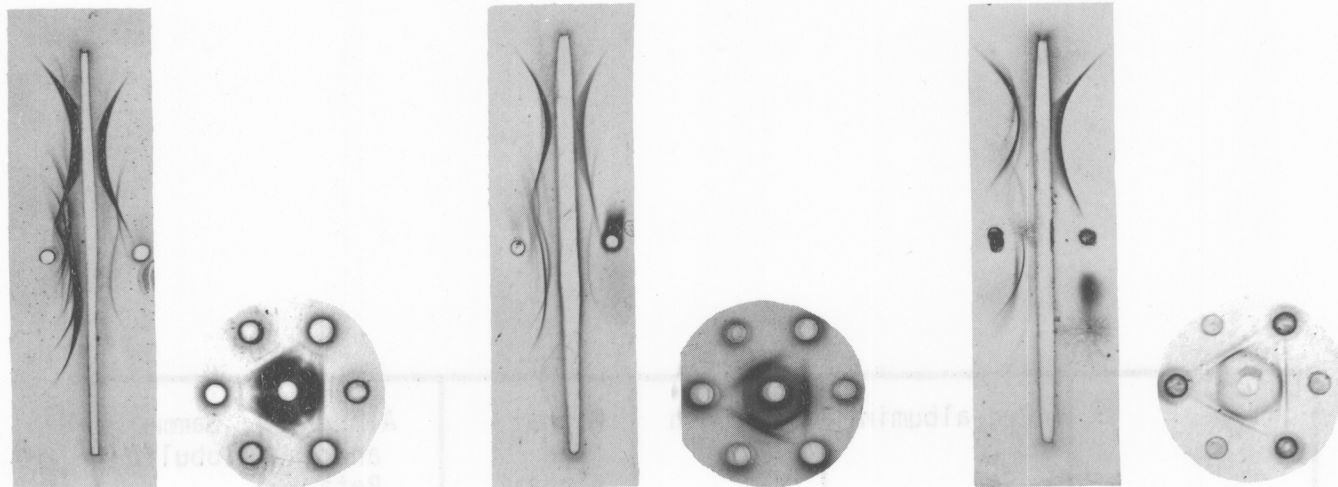


	Pre-albumin		Albumin		Alpha ₀ and Alpha ₁ Globulins		Alpha ₂ and Beta Globulins		Gamma Globulin	
	C*	M*	C*	M*	C*	M*	C*	M*	C*	M*
Golden Eagle Serum Dry Blood Meat	W	W W	X	X X X	X	S S W	X	S X	W W X	W X X

GOLDEN EAGLE

Aquila chrysaetos

VERSUS CHICKEN ANTISERUM

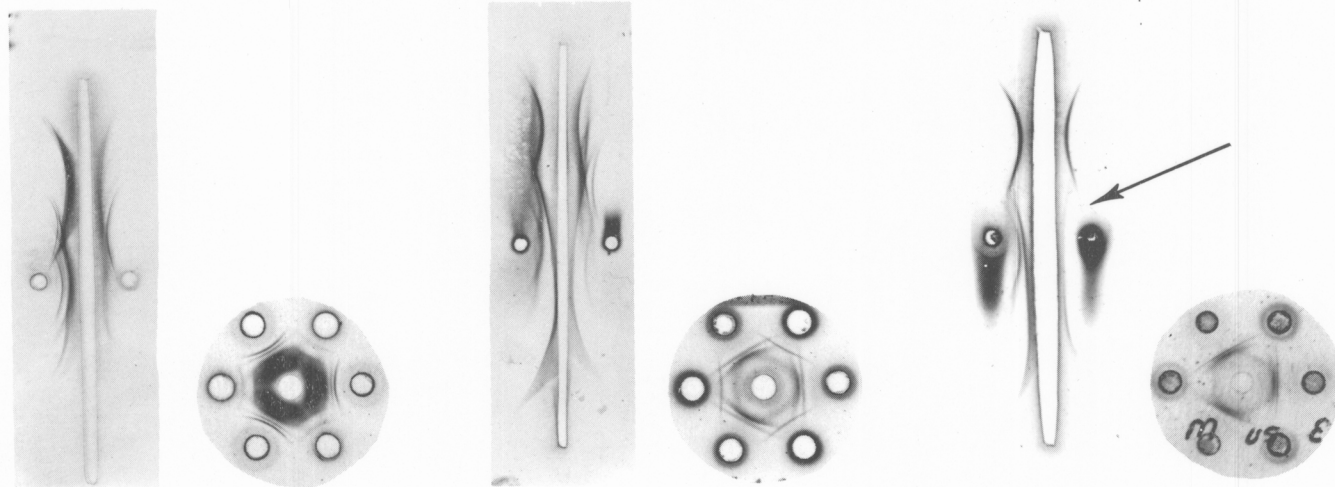


Serum

Dry Blood

Meat

VERSUS MALLARD ANTISERUM



Serum

Dry Blood

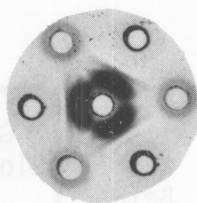
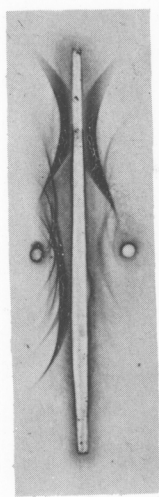
Meat

	Pre-albumin		Albumin		Alpha ₀ and Alpha ₁ Globulins		Alpha ₂ and Beta Globulins		Gamma Globulin	
	C*	M*	C*	M*	C*	M*	C*	M*	C*	M*
Snow Goose										
Serum	w	x	x	x	s	x	s	s		w
Dry Blood	w		x	x			w	w		x
Meat	x	x	x	x			ws	w		x

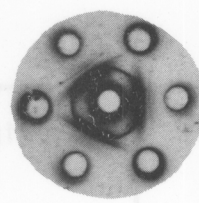
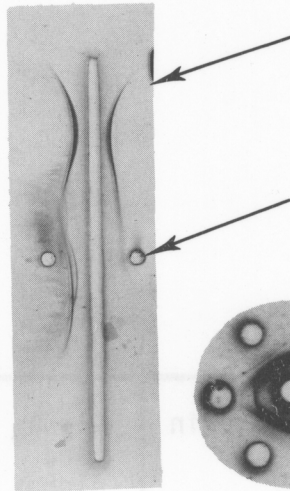
SNOW GOOSE

Chen hyperborea

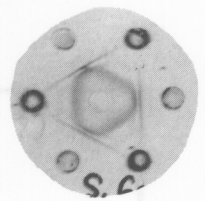
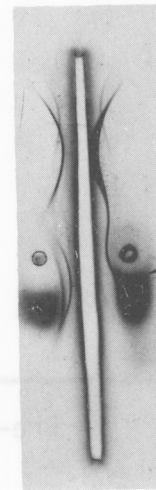
VERSUS CHICKEN ANTISERUM



Serum

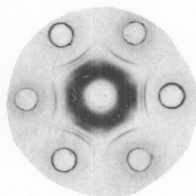
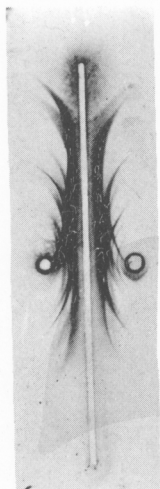


Dry Blood

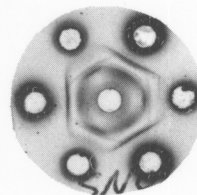
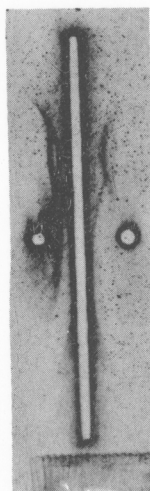


Meat

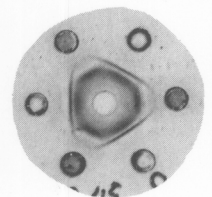
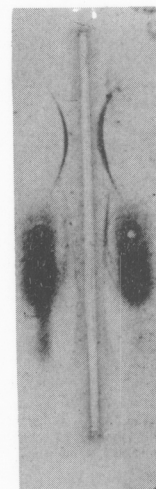
VERSUS MALLARD ANTISERUM



Serum



Dry Blood

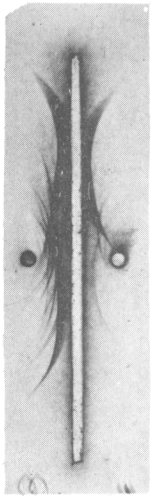


Meat

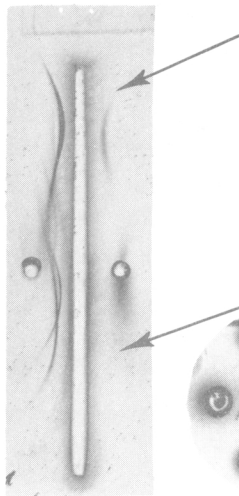
	Pre-albumin		Albumin		Alpha ₀ and Alpha ₁ Globulins		Alpha ₂ and Beta Globulins		Gamma Globulin	
	C*	M*	C*	M*	C*	M*	C*	M*	C*	M*
Eared Grebe										
Serum		X	X	X	W	WS	S	S		S
Dry Blood	W	W	X	X		X			W	W
Meat	W	W	X	X		W			X	X

EARED GREBE *Podiceps caspicus*

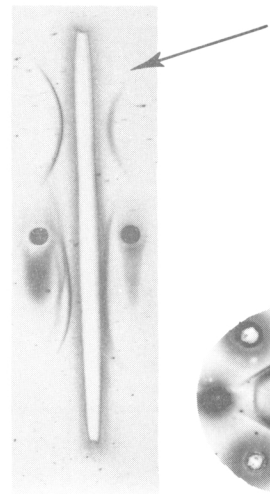
VERSUS CHICKEN ANTISERUM



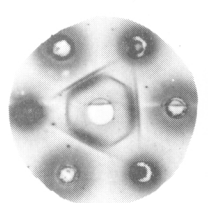
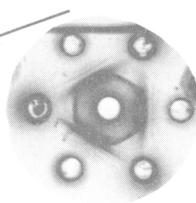
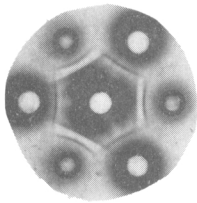
Serum



Dry Blood



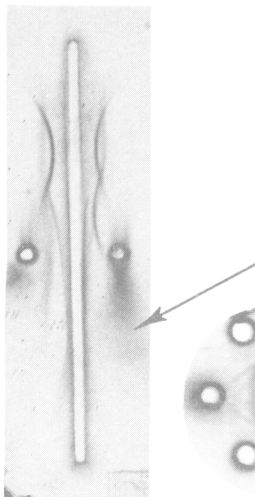
Meat



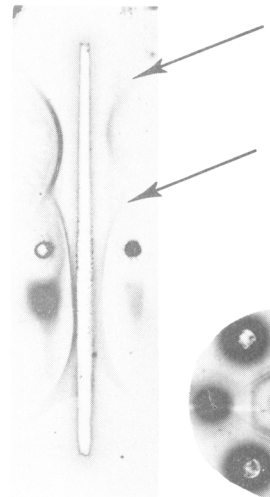
VERSUS MALLARD ANTISERUM



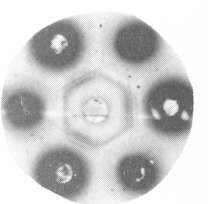
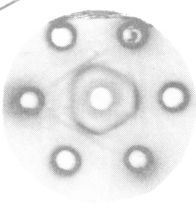
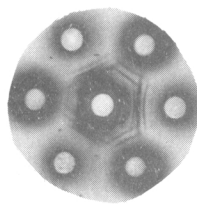
Serum



Dry Blood



Meat

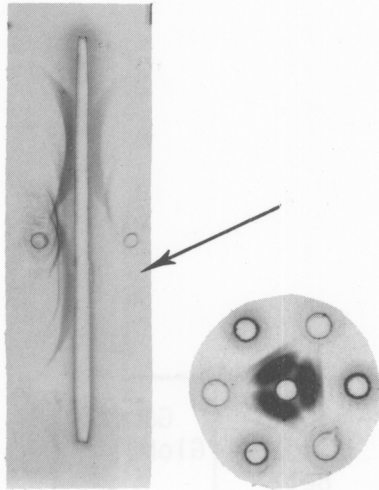


	Pre-albumin		Albumin		Alpha ₀ and Alpha ₁ Globulins		Alpha ₂ and Beta Globulins		Gamma Globulin	
	C*	M*	C*	M*	C*	M*	C*	M*	C*	M*
Red-Tailed Hawk										
Serum		X	X	X	X	S	WS	S		W
Dry Blood		W	X	X		X		W	W	X
Meat	W		X	X				W	W	X

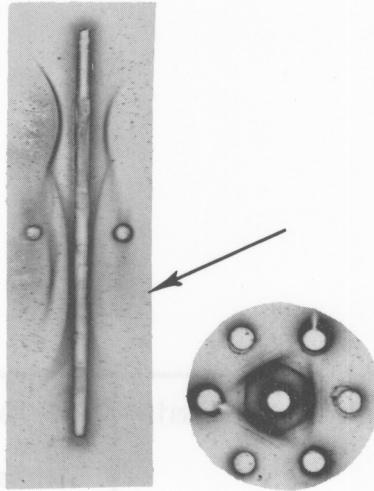
RED-TAILED HAWK

Buteo jamaicensis

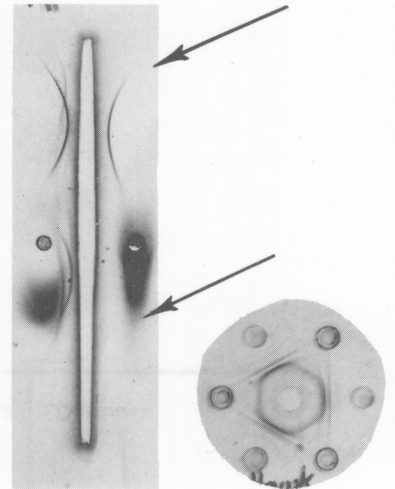
VERSUS CHICKEN ANTISERUM



Serum

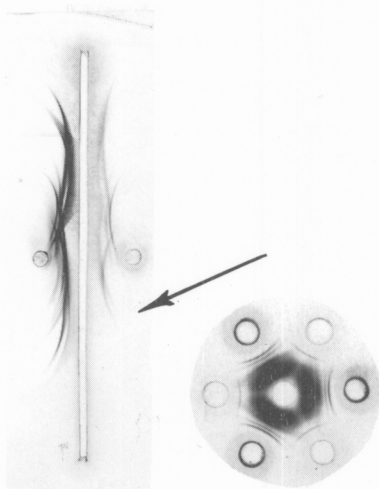


Dry Blood

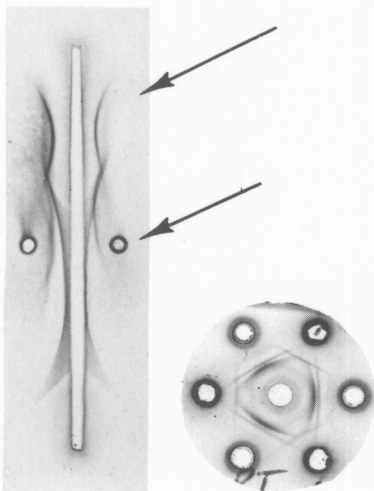


Meat

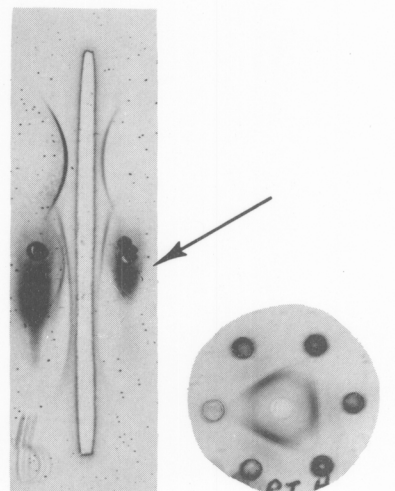
VERSUS MALLARD ANTISERUM



Serum



Dry Blood



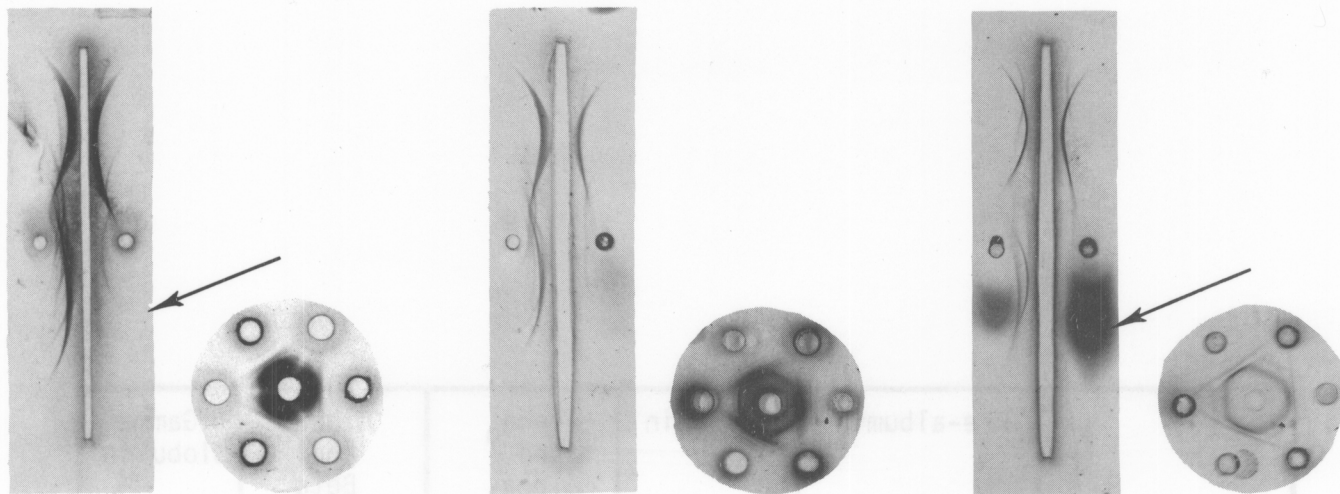
Meat

	Pre-albumin		Albumin		Alpha ₀ and Alpha ₁ Globulins		Alpha ₂ and Beta Globulins		Gamma Globulin	
	C*	M*	C*	M*	C*	M*	C*	M*	C*	M*
Great-Horned Owl										
Serum	x	x	x	x	x	s	x	s	w	x
Dry Blood	x	w	x	x	x	s	w	w	w	w
Meat	x	w	x	x		w			w	x

GREAT HORNED OWL

Bubo virginianus

VERSUS CHICKEN ANTISERUM

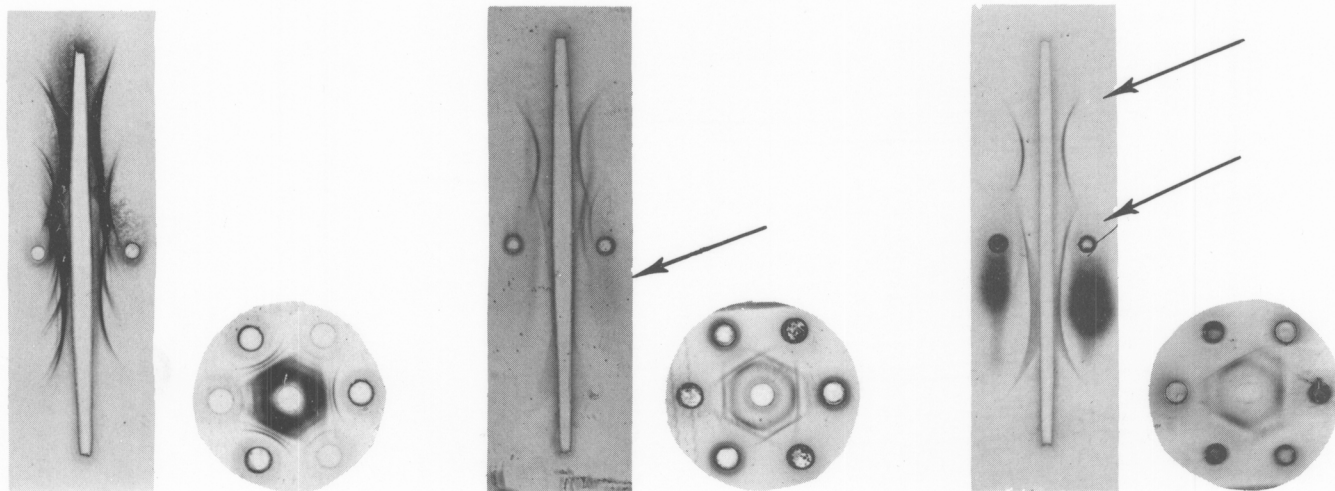


Serum

Dry Blood

Meat

VERSUS MALLARD ANTISERUM



Serum

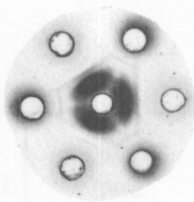
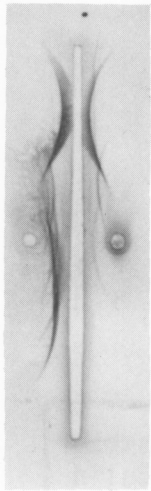
Dry Blood

Meat

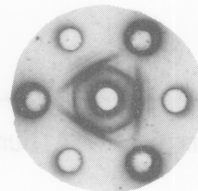
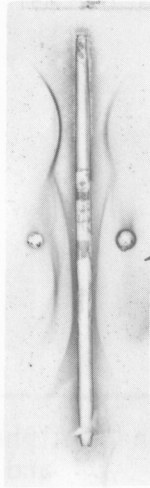
	Pre-albumin		Albumin		Alpha ₀ and Alpha ₁ Globulins		Alpha ₂ and Beta Globulins		Gamma Globulin	
	C*	M*	C*	M*	C*	M*	C*	M*	C*	M*
White Pelican Serum Dry Blood Meat	x	x w	x x x	x x x	x x w	x w w	x w	x	x w w	x w w

WHITE PELICAN *Pelecanus erythrorhynchos*

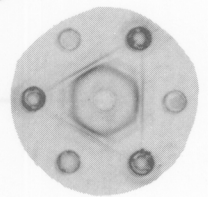
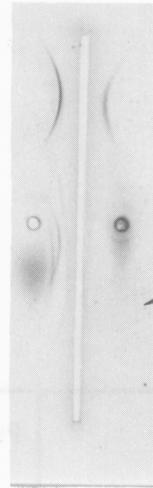
VERSUS CHICKEN ANTISERUM



Serum

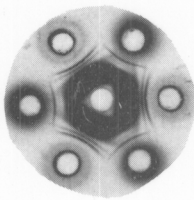
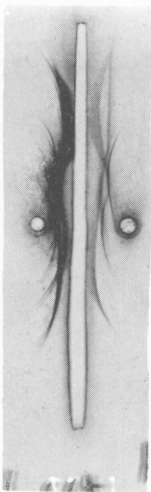


Dry Blood

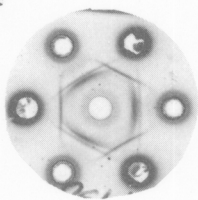
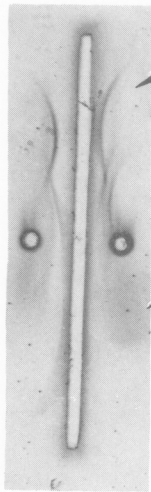


Meat

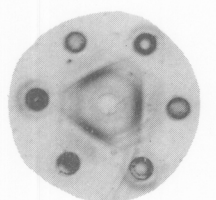
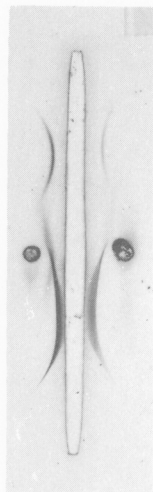
VERSUS MALLARD ANTISERUM



Serum



Dry Blood



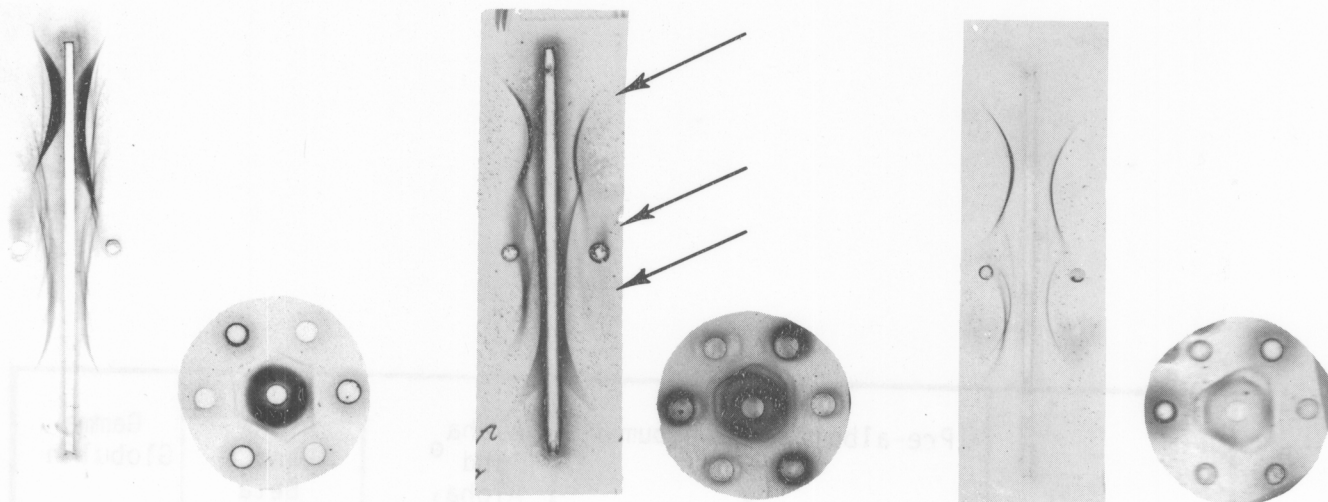
Meat

	Pre-albumin		Albumin		Alpha ₀ and Alpha ₁ Globulins		Alpha ₂ and Beta Globulins		Gamma Globulin	
	C*	M*	C*	M*	C*	M*	C*	M*	C*	M*
Ring-necked Pheasant Serum	X	X	X	X	S	S	S	S	X	S
Dry Blood	W	X	X	X	W	X	W	X	X	X
Meat			X	X		W			X	X

RING-NECKED PHEASANT.

Phasianus colchicus

VERSUS CHICKEN ANTISERUM

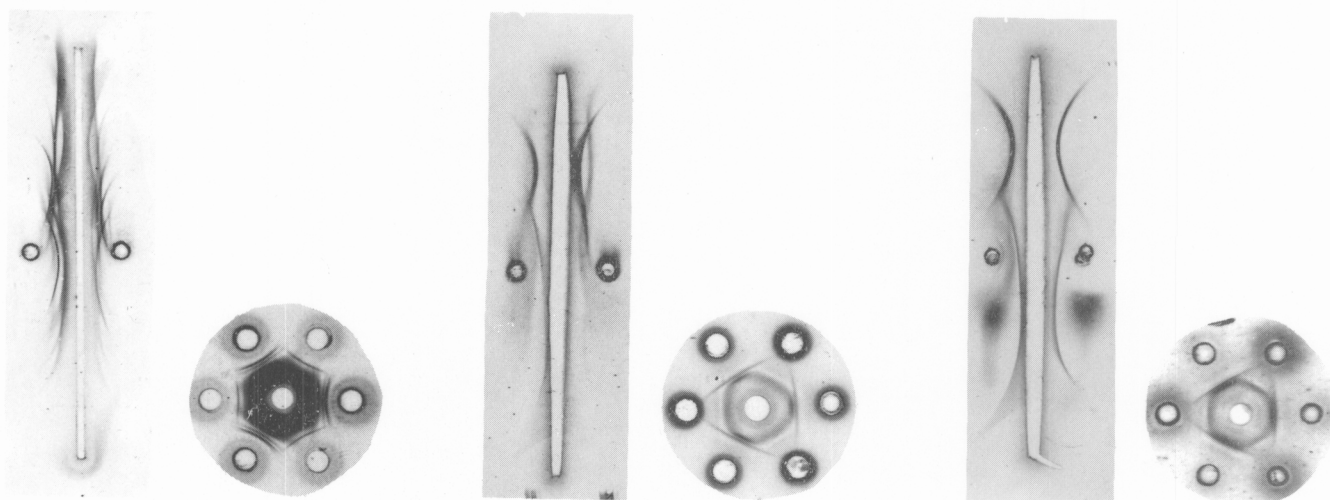


Serum

Dry Blood

Meat

VERSUS MALLARD ANTISERUM



Serum

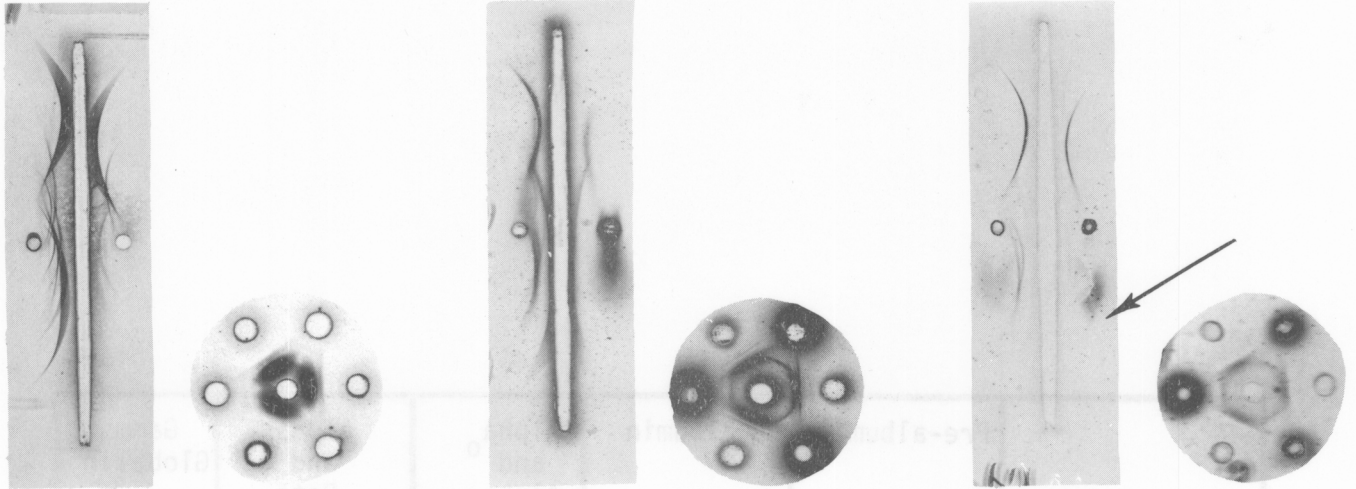
Dry Blood

Meat

	Pre-albumin		Albumin		Alpha ₀ and Alpha ₁ Globulins		Alpha ₂ and Beta Globulins		Gamma Globulin	
	C*	M*	C*	M*	C*	M*	C*	M*	C*	M*
Pigeon										
Serum		X	X	X	X	S	S	S	W	W
Dry Blood		W	X	X		X			X	X
Meat		W	X	X					W	X

PIGEON *Columba livia*

VERSUS CHICKEN ANTISERUM

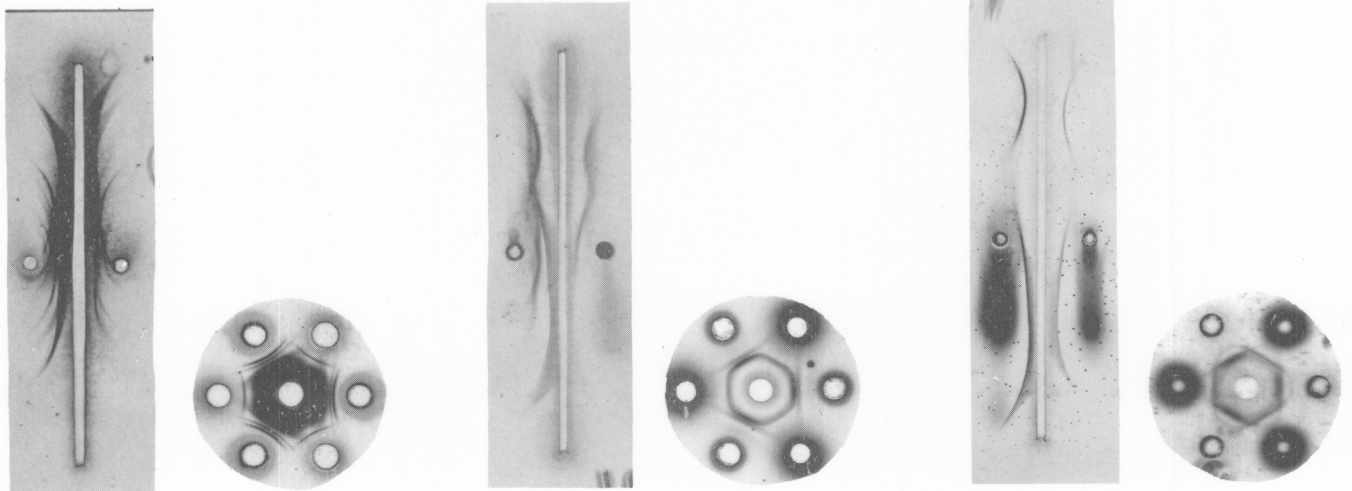


Serum

Dry Blood

Meat

VERSUS MALLARD ANTISERUM



Serum

Dry Blood

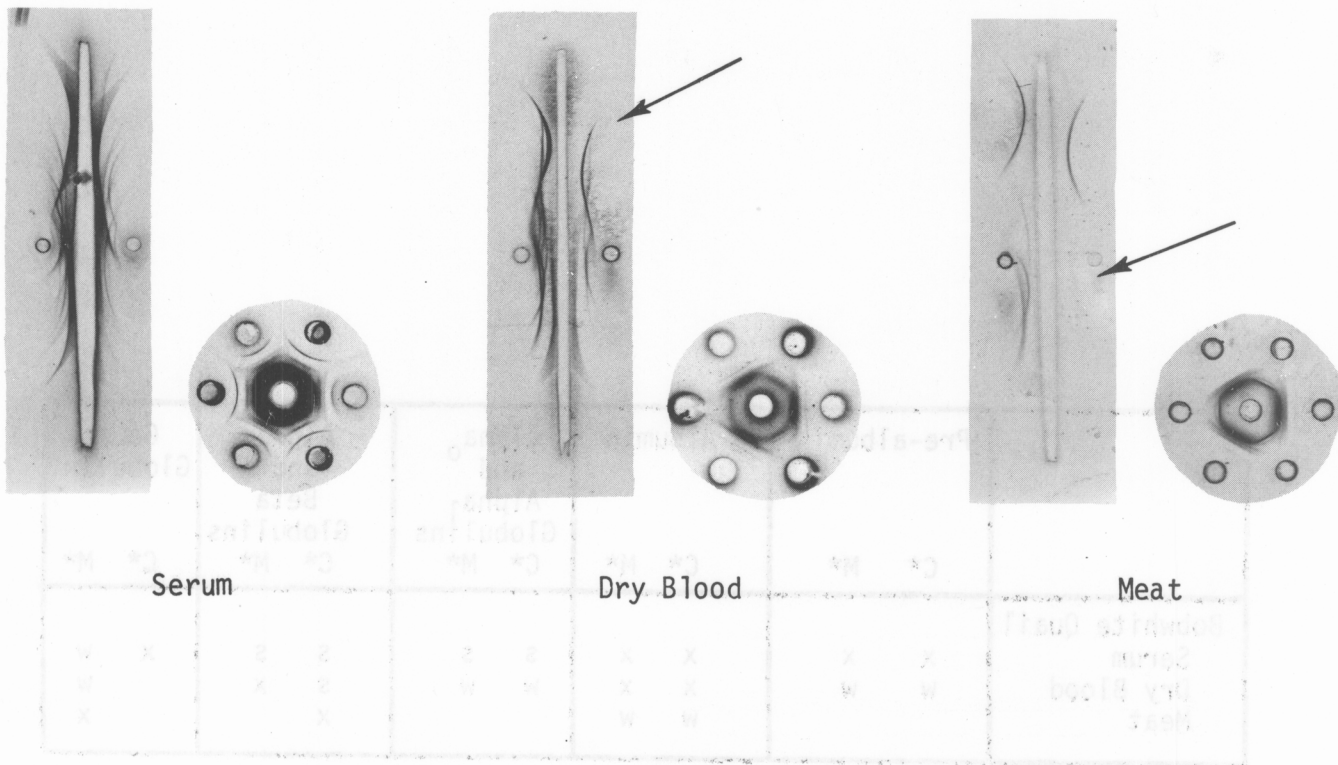
Meat

	Pre-albumin		Albumin		Alpha ₀ and Alpha ₁ Globulins		Alpha ₂ and Beta Globulins		Gamma Globulin	
	C*	M*	C*	M*	C*	M*	C*	M*	C*	M*
Prairie Chicken										
Serum	X		X	X	S	S	S	S	X	X
Dry Blood	W	X	X	X			S	W	W	X
Meat			X	X			W			X

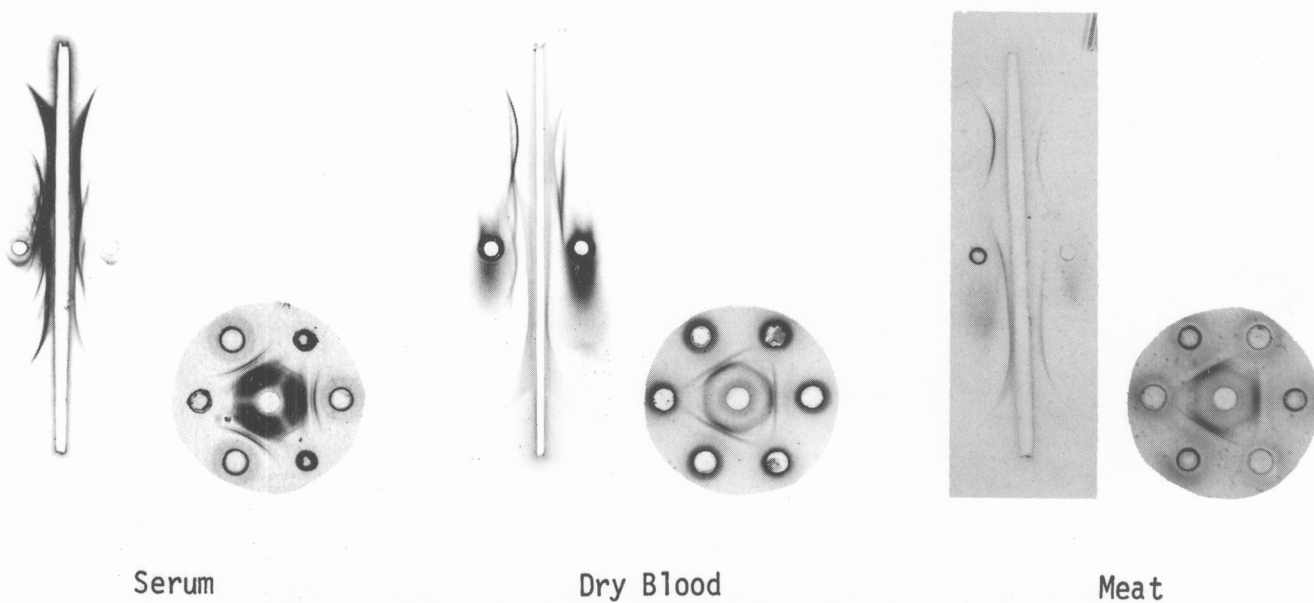
PRAIRIE CHICKEN

Tympanuchus cupido

VERSUS CHICKEN ANTISERUM



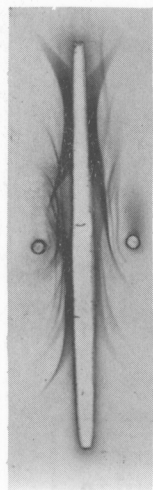
VERSUS MALLARD ANTISERUM



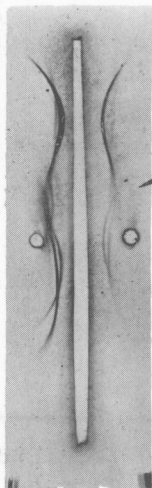
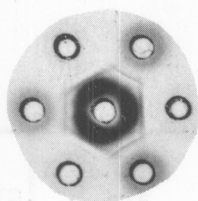
	Pre-albumin		Albumin		Alpha ₀ and Alpha ₁ Globulins		Alpha ₂ and Beta Globulins		Gamma Globulin	
	C*	M*	C*	M*	C*	M*	C*	M*	C*	M*
Bobwhite Quail Serum	x	x	x	x	s	s	s	s	x	w
Dry Blood	w	w	x	x	w	w	s	x		w
Meat			w	w			x			x

BOBWHITE QUAIL *Colinus virginianus*

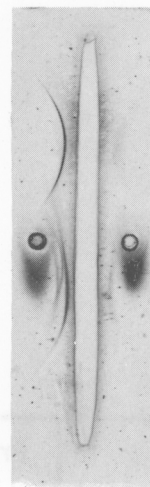
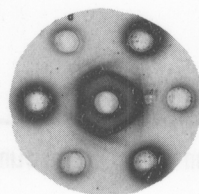
VERSUS CHICKEN ANTISERUM



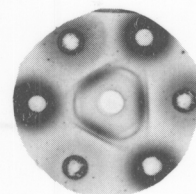
Serum



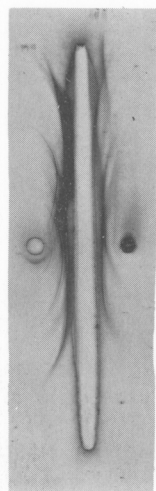
Dry Blood



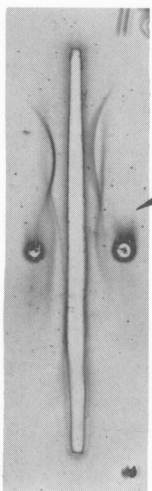
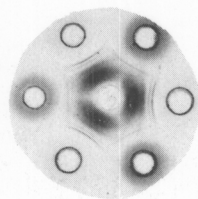
Meat



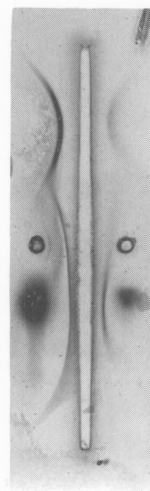
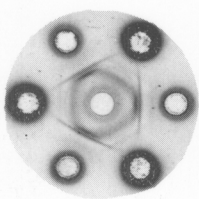
VERSUS MALLARD ANTISERUM



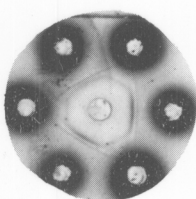
Serum



Dry Blood



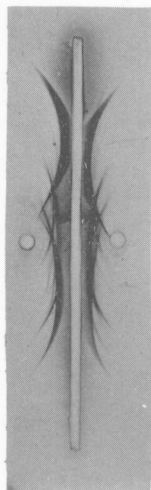
Meat



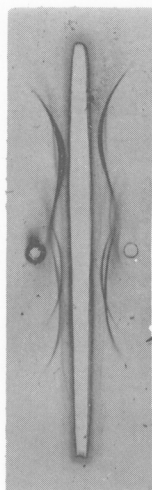
	Pre-albumin		Albumin		Alpha ₀ and Alpha ₁ Globulins		Alpha ₂ and Beta Globulins		Gamma Globulin	
	C*	M*	C*	M*	C*	M*	C*	M*	C*	M*
Merriam's Turkey Serum	X	X	X	W	S	S	S	S	X	X
Dry Blood		X	X	X	WS	W	S	WS	W	W
Meat			X	X	W		S	W	X	X

MERRIAM TURKEY *Meleagris gallopavo*

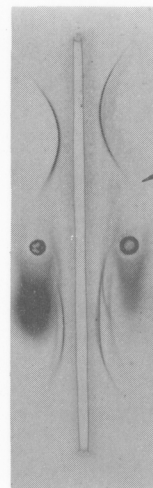
VERSUS CHICKEN ANTISERUM



Serum

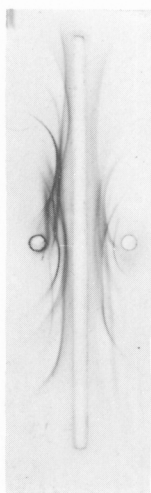


Dry Blood

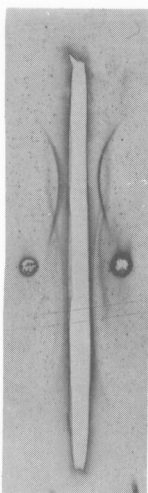


Meat

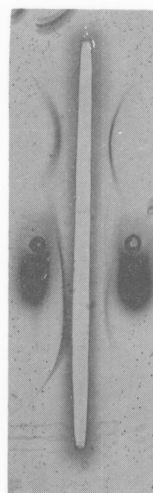
VERSUS MALLARD ANTISERUM



Serum



Dry Blood



Meat

DISCUSSION

Avian cross reactions will be covered in less detail than those for mammals, since all avian species cross-reacted with chicken and mallard antisera. Although strong cross reactions occur when chicken and mallard antisera are employed, both chicken and mallard can still be segregated from other avian species examined in this study.

Several early investigators, using the precipitin reaction, found that their rabbit-produced antisera also cross-reacted with several bird species (Reeves and Hammon, 1944; Williams et al., 1958). Hurlbut and Weitz (1958) found their antiserum reacted with all the tested bird serums. Tempelis and Reeves (1962) found chicken-produced antiserum to be more species specific than rabbit-produced antiserum, but sensitivity was still dependent upon the individual chicken producing the antiserum.

Defalco (1940) stated, "The fact that the sera of members of the various orders of birds reacted with most of the precipitating antisera is a strong indication of the chemical similarity of all birds...birds are the most homogeneous class of vertebrates both morphologically and serologically." Even earlier, Nuttall (1904) stated there was "a similarity of the blood constitution of all birds." Sibley and Hendrickson (1970) came to a similar conclusion when using starch gel electrophoresis to examine approximately 1,500 specimens, representing 450 species of birds. They concluded that their comparisons revealed a high degree of individual variation superimposed upon what seemed to be a common basic pattern. Once the taxonomically nonsignificant variation was eliminated from the patterns, they found a remarkable similarity in all birds. The taxonomically nonsignificant variations include genetic polymorphism and possibly age, sex, condition of health, degree of starvation, reproductive conditions, and perhaps others.

In our study, both chicken and mallard antisera cross-reacted with all avian species tested. No cross reactions were observed with any of the mammals examined. Similar observations were noted when snapping turtle, carp, and catfish were tested against chicken and mallard antisera. However, chicken antiserum has cross-reacted with snapping turtle (Wolfe, 1939).

Table I points out protein components observed in the immunoelectrophoresis patterns. For most species one or more arcs were evident for each protein component. Of the species examined, deviations occurred only in mourning dove and snow goose. No gamma globulin arc was observed for either snow goose or mourning dove when reacted with chicken antiserum. However, gamma globulin arcs were often difficult to discern since the leading edge of the precipitin arc was very weak.

Even though a blank may be shown in Table I for a particular protein component, it does not preclude the possibility of that arc appearing in some future test. For example, great-horned owl displayed a weak gamma globulin arc for both serum and meat when using chicken antiserum. A gamma globulin arc would also be expected for dry blood but was not observed. Since the antibodies were produced to serum, one would also expect a protein component observed in dry blood or meat to occur in serum unless certain protein constituents were chemically altered.